(12) UK Patent Application (19) GB (11) 2 095 053 A

(21) Application No 8203360
(22) Date of filing 5 Feb 1982
(30) Priority data
(31) 1142/81
(32) 20 Feb 1981
(33) Switzerland (CH)
(43) Application published
22 Sep 1982
(51) INT CL³
H02J 15/00 F42C 11/02
H01L 41/00
(52) Domestic classification
H2H 23B FQ SS
(56) Documents cited
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(58) Field of search
H2H
H2A
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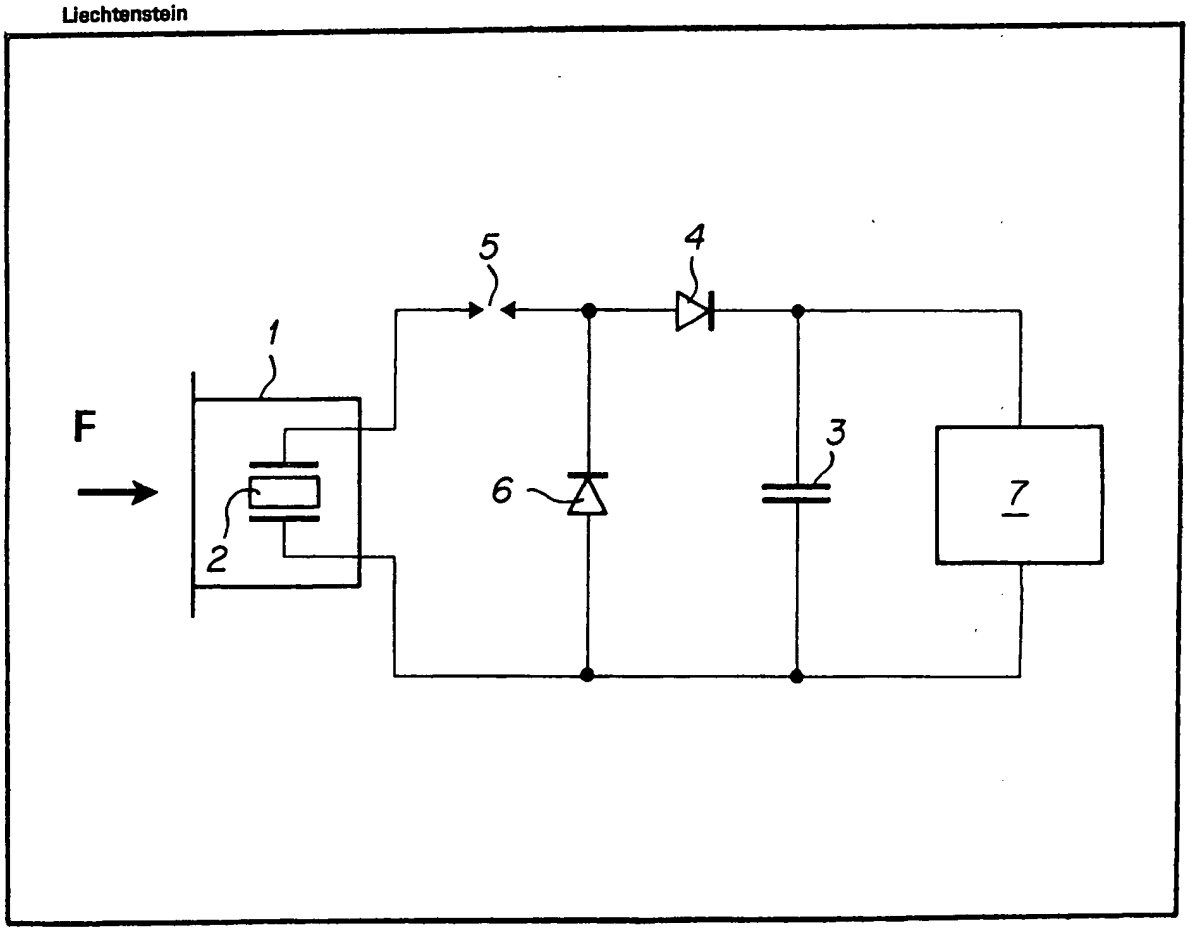
(54) Power supply using a piezoelectric generator

(57) An electric current generator comprises a piezoelectric crystal 2 having its electrodes connected to a load circuit comprising in series a capacitor 3, a rectifier 4 and a spark gap 5, a consumer circuit 7 being connected to the terminals of the capacitor 3.

The circuit permits the charging of a capacitor of relatively large capacity to voltages sufficient for supplying, for example, a relatively complex electronic circuit, or for triggering a detonator.

The force F for exciting the crystal 2 may result from an isolated shock for triggering a detonator, or result from an accelerated or decelerated movement of a carrier of the generator, the generator being mounted, for example, on a projectile, a person, or a vehicle.



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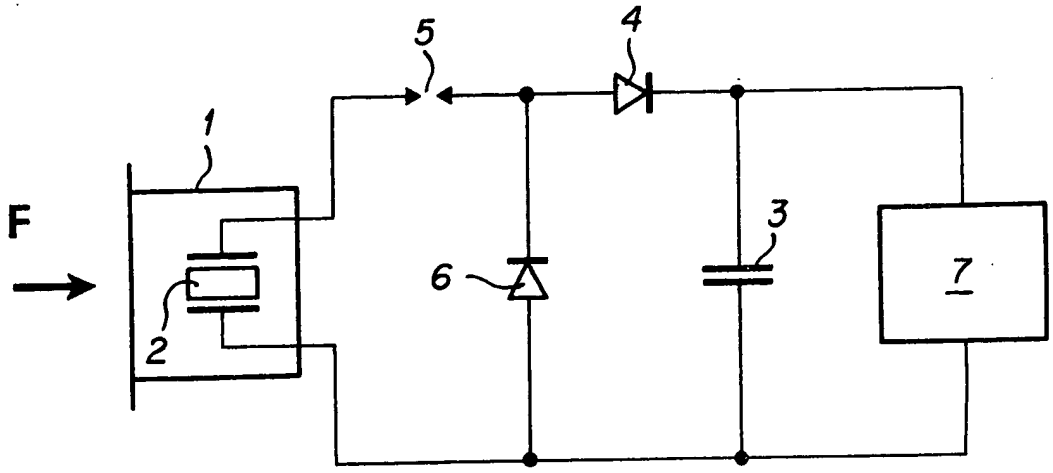
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SPECIFICATION

Electric current generator

The present invention relates to an electric current generator energised by mechanical energy, and including a mechano-electric converter using a piezoelectric crystal and an electric load circuit connected to the electrodes of this converter. According to the present invention, the load circuit comprises in series a condenser, a rectifier and a needle or point spark gap, the terminals of the condenser forming connections for a consumer circuit.

An object of the invention is to provide a current generator which is independent of a battery or other external electrical energy source, and which consequently avoids the disadvantages connected with the usual supply arrangements. More particularly, in the case of generators that are required to operate after a relatively long period of storage or inactivity or in the case of arrangements in which the effective life, the cost, the weight or the bulkiness of a battery represent a series inconvenience, the present invention provides an extremely useful solution. Thus, the invention may especially be applied to an arrangement for triggering the primer of an explosive device, to the supply for an electronic circuit, such as a logic circuit, or to the supply for a portable electronic apparatus which is subject to isolated or repeated mechanical actions, such as shock, acceleration or deceleration, according to the case of application.

The invention will be better understood in the light of the following description, illustrated by the accompanying drawing, in which one embodiment of an electric current generator according to the invention is illustrated by way of example.

The single figure of the drawing shows diagrammatically a piezoelectric crystal 2 contained in a capsule 1 which is capable of being subjected to the force F of a mechanical energy source. Connected in series with the piezoelectric crystal are a condenser 3, a diode 4 and a point spark gap 5. Another diode 6 is connected in parallel with the piezoelectric crystal 2 and the spark gap 5. A consumer circuit 7 is connected in parallel with the condenser 3.

The piezoelectric crystal may be of a conventional type, such as described, for example, in the book "Piezoelectric ceramics", edited by J. van Randeraat et al., N. V. Philips' Gloeilampenfabrieken, Eindhoven, 2nd edition 1974, for an ignition device (chapter 3, pages 23 to 39).

According to the invention, the series connection of the point spark gap 5 and the condenser 3, in combination with the diodes 4 and 6, permits a voltage of a few volts up to several tens of volts to be obtained at the condenser 3 according to the capacity. In certain constructional examples, capacities of 20 μF were used for obtaining a voltage of 10 V, or capacities of 0.1 μF for obtaining a voltage of 140 V; in other words, a quantity of energy of about 1 mJ was accumulated.

The spark gap 5 plays an essential part in this arrangement, because it is not possible, starting with a piezoelectric crystal, directly to charge a condenser of relatively large capacity to voltages sufficient for the supply, for example, of a relatively complex electronic circuit.

The diodes 4 and 6 permit the condenser 3 to be charged by positive and negative current inpulses.

The consumer circuit 7 may, for example, be a high-impedance electronic circuit or, in one particular case, the primer of a detonation device or any other appropriate circuit.

The excitation of the piezoelectric crystal 2 may, for example, result from an isolated shock for triggering a detonator or result from an accelerated or decelerated movement of a mobile carrier of the generator. For example, the generator may be mounted on a projectile and control a safety device, or it may be carried by a person or be mounted on a vehicle.

In all the cases where it is used, the electrical energy source has an indefinite effective life and presents a very high degree of safety in operation.

Claims

1. An electric current generator comprising a mechano-electric converter including a piezoelectric crystal, and, connected to the electrodes of the converter, a load circuit comprises in series a condenser, a rectifier and a point spark gap, the terminals of the condenser forming connections for a consumer circuit.

2. An electric current generator according to Claim 1, including a two-phase rectifying arrangement.

3. An electric current generator substantially as herein described with reference to the accompanying drawing.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.